



On-line support of Precalculus
learning: who may and who does
benefit from the use of technology?

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Goals of today's presentation

- Describe our practice of introducing educational software in teaching pre-calculus course
- Report our observations and results



Background on the Precalculus course

- Is open for students with a Math Placement Test score above 55%
- Is required for registration in the Calculus course if the MPT score is below 80%
- Provides an opportunity to learn basic but fundamental mathematical concepts and to improve computational and logical skills

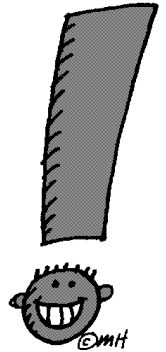


Background on the Precalculus course

- Course material overlaps with high school material
- Offers new perspectives
 - Lecture format and homework assignments
 - More complex procedural techniques
 - More formal approach



Background on the Precalculus course



- Course population
 - Number of students – (25 to 300)
 - Different levels of preparation



Instructors' and administration's concern

Main concern

Failure rate is about 30% per year





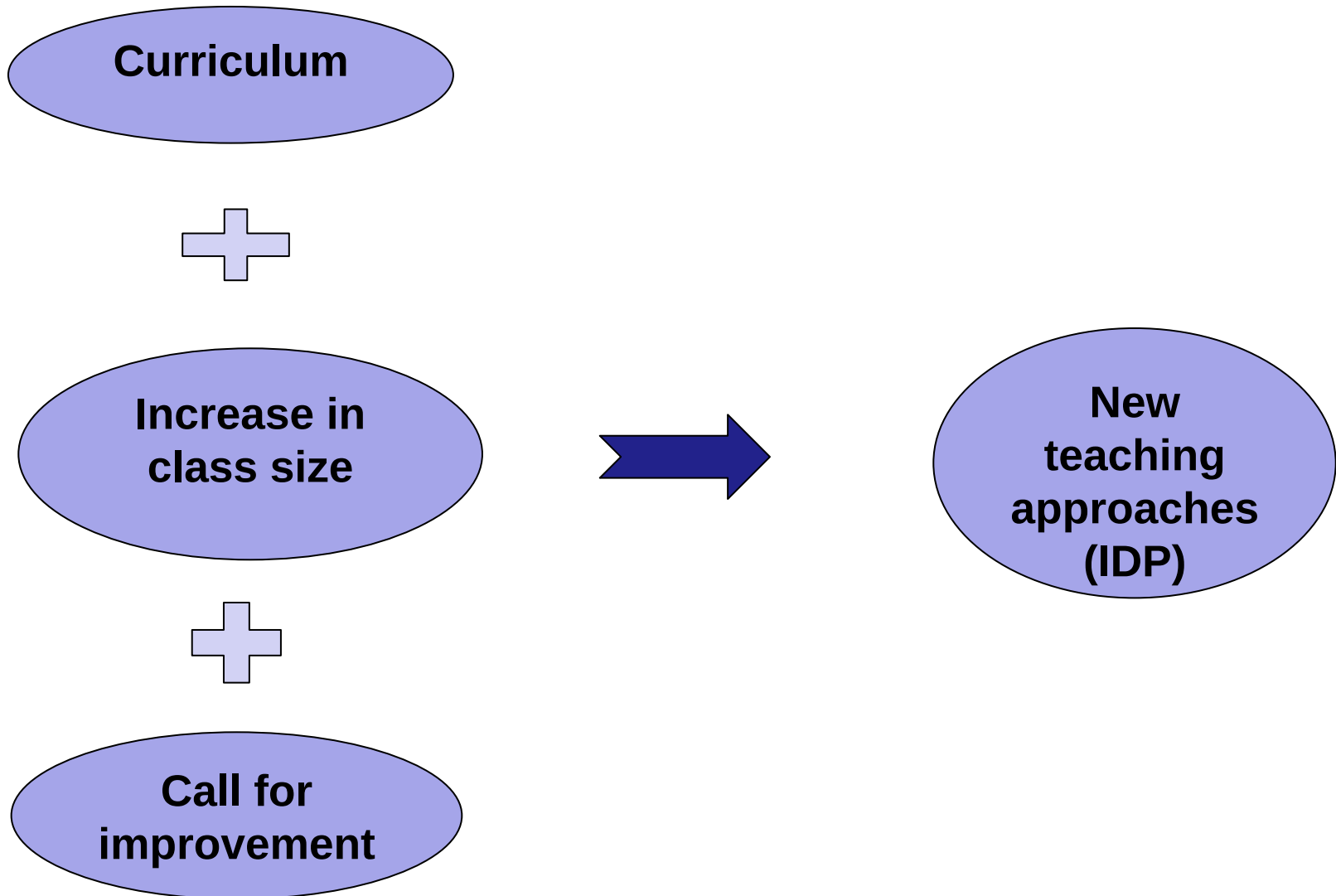
Some reasons of high failure

- Students' math skills
 - Weak algebraic and arithmetic skills
 - Poor reasoning ability with formal concepts
 - Preference for procedural/rigid algorithmic approaches
 - Failure to check/validate answers or solution processes
- Negative attitudes, low motivation, low mastery goals
 - e.g. "I just want to pass this course"
- Poor time management skills





New developments: Instructional Development Project





What a computer assisted learning environment can do

- Provides the field of experience and supports meaningful interpretations and validations within the field
- Supports development of mathematical ideas; flexibility allows investigations, making and checking hypothesis
- Supports development of mathematical language and allows communication between students and the teacher
- Supports review, comparison and rethinking processes for students via monitoring and recording written work done by students
- Helps students to gradually take responsibilities for learning and problem solving activities
- Allows the teacher to configure the system according to his/her educational goals and tasks and students needs



Instructor's objectives in our project

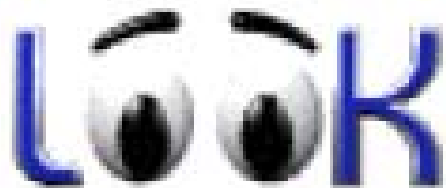


- » To provide more examples and exercises for students
- » To organize math resources
- » To use quick assessment tools
- » To monitor achievement
- » To collect additional information
- » To increase effectiveness of teaching



Desired and potential benefits for students in our project

- » Improve basic algebraic skills – as a by-product of solving problems
- » Allow self-diagnosing common mistakes
- » Enhance reasoning skills
- » Improve conceptual understanding
- » Develop positive attitudes
- » Increase effectiveness of learning





Time	Class size	Course format
2007 Spring semester	26	Lecture: 4 times a week Computer Lab → once a week
2007 Fall semester	127	Lecture: 4 times a week Computer Lab → once a week

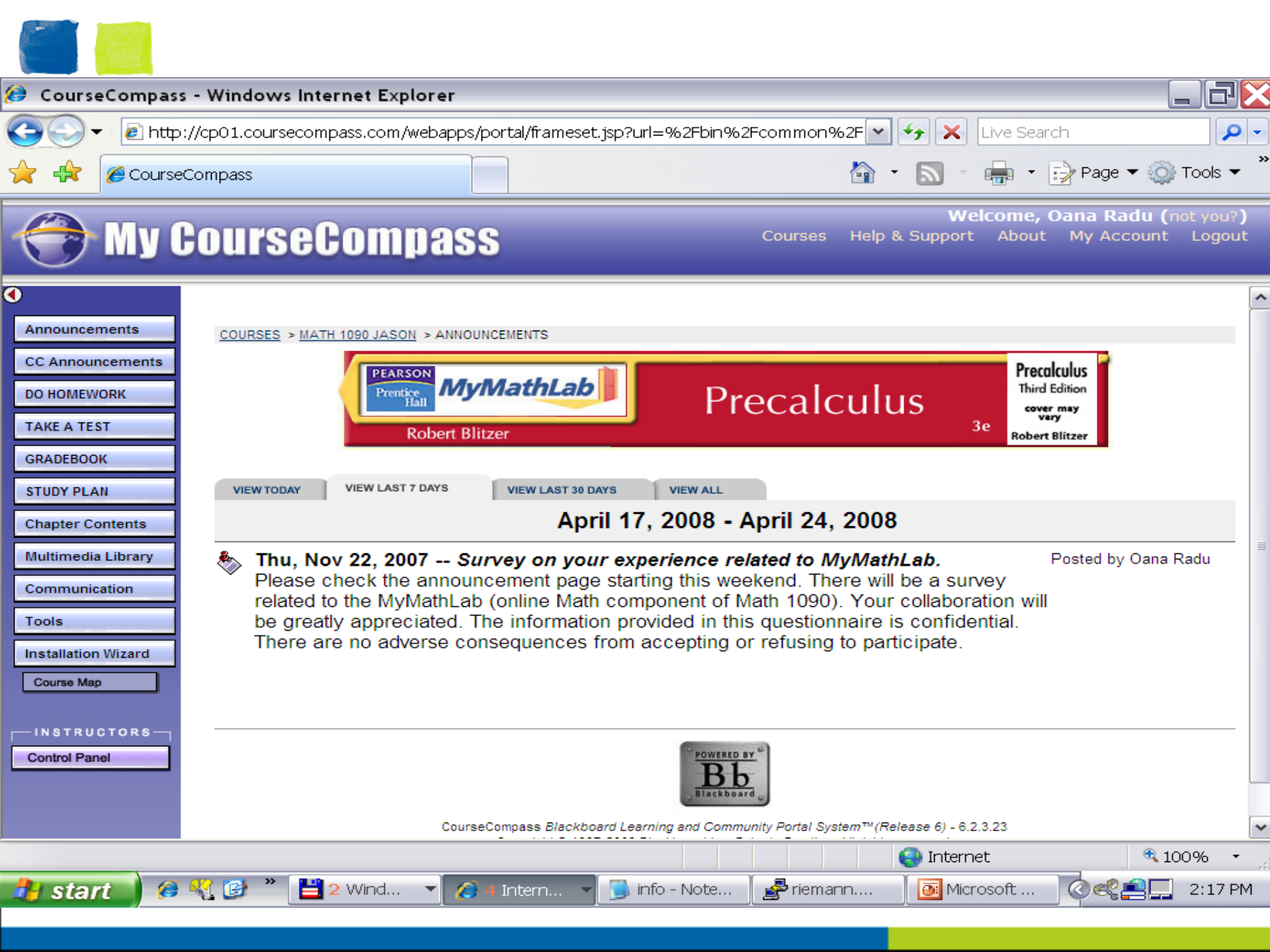
Time	Class size	Course format
2009 Winter semester	70	Lecture + lab: 4 times a week Online assistance
2009 Spring semester	25	Lecture + lab: 4 times a week Online assistance



Software features

- Announcements
- Do homework
- Take a test
- Study plan
- Results
- Electronic textbook
- Practice tutorial exercises
- Video lectures
- Multimedia library
- Discussion board
- E-mail





[Course Calendar](#)

[Legend](#)

Homework and Tests: Homework

Show All Homework Quizzes & Tests Chapters

All Homework Assignments

Due	Assignment	Time Limit	Attempts	Gradebook Score
	Lab 1 Practice Exercise 1			see score
	Lab 1 Practice Exercise 2			
	Lab 2 Practice Exercise 3			
	Lab 3 Practice Exercise 4			see score
	Lab 4 Practice Exercise 5			
	Lab 5 Practice Exercise 6			
	Lab 6 Practice Exercise 7			
	Lab 7 Practice Exercise 8			
	Lab 10 Practice Exercise 11 Jason			
	Lab 9 Practice Exercise 9 Jason			

This course is based on Blitzer: Precalculus, 3e
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Homework Lab 3 Practice Exercise 4[Homework Overview](#) [Back to Homework & Tests](#)Questions
1 2 3 4 5 6 7 8 9 10

Oana Radu

Simplify the rational expression. Find all numbers that must be excluded from the domain of the simplified rational expression.

$$\frac{x^2 + 10x + 25}{x^2 - 25}$$

$$\frac{x^2 + 10x + 25}{x^2 - 25} = \boxed{1}, x \neq \boxed{5}$$

(Use a comma to separate answers as needed.)

Help Me Solve This

View an Example

Video

Textbook Pages

Ask My Instructor...

Print...

Exercise Score:

0 of 1 pts

Homework Score:

0% (0 of 15 pts)

Enter any number or expression in each of the blue-outlined boxes, then click Check Answer.

Check Answer

Clear Answer

Problem Progress

Submit Work

Simplify the rational expression. Find all numbers that must be excluded from the domain of the simplified rational expression.

$$\frac{x^2 + 22x + 121}{x^2 - 121}$$

First, we factor the numerator, $x^2 + 22x + 121$.

$$x^2 + 22x + 121 = (x + 11)^2$$

Now we factor the denominator, $x^2 - 121$.

$$x^2 - 121 = (x + 11)(x - 11)$$

Before we continue, take notice of the factored denominator.

$$\frac{x^2 + 22x + 121}{x^2 - 121} = \frac{(x + 11)^2}{(x + 11)(x - 11)}$$

Remember that we must exclude numbers that make the denominator zero from the rational expression's domain. Therefore, we must exclude -11 and 11 from the domain.

Now we divide both the numerator and the denominator by any common factors.

$$\begin{aligned}\frac{x^2 + 22x + 121}{x^2 - 121} &= \frac{(x + 11)^2}{(x + 11)(x - 11)} && \text{Factor the numerator and denominator.} \\ &= \frac{\cancel{(x + 11)}(x + 11)}{\cancel{(x + 11)}(x - 11)} && \text{Divide out the common factor } x + 11. \\ &= \frac{x + 11}{x - 11}, x \neq -11, 11\end{aligned}$$

Click Continue to see more.

Continue

Done

Problem Progress



Summary of students' responses (2007)

Computer math lab was helpful for:

- Understanding mathematical concepts 48%
- Achieving a higher grade in the course than they would have gotten without it 38%
- Receiving feedback while solving online exercises 51%



Summary of students' responses (2007)

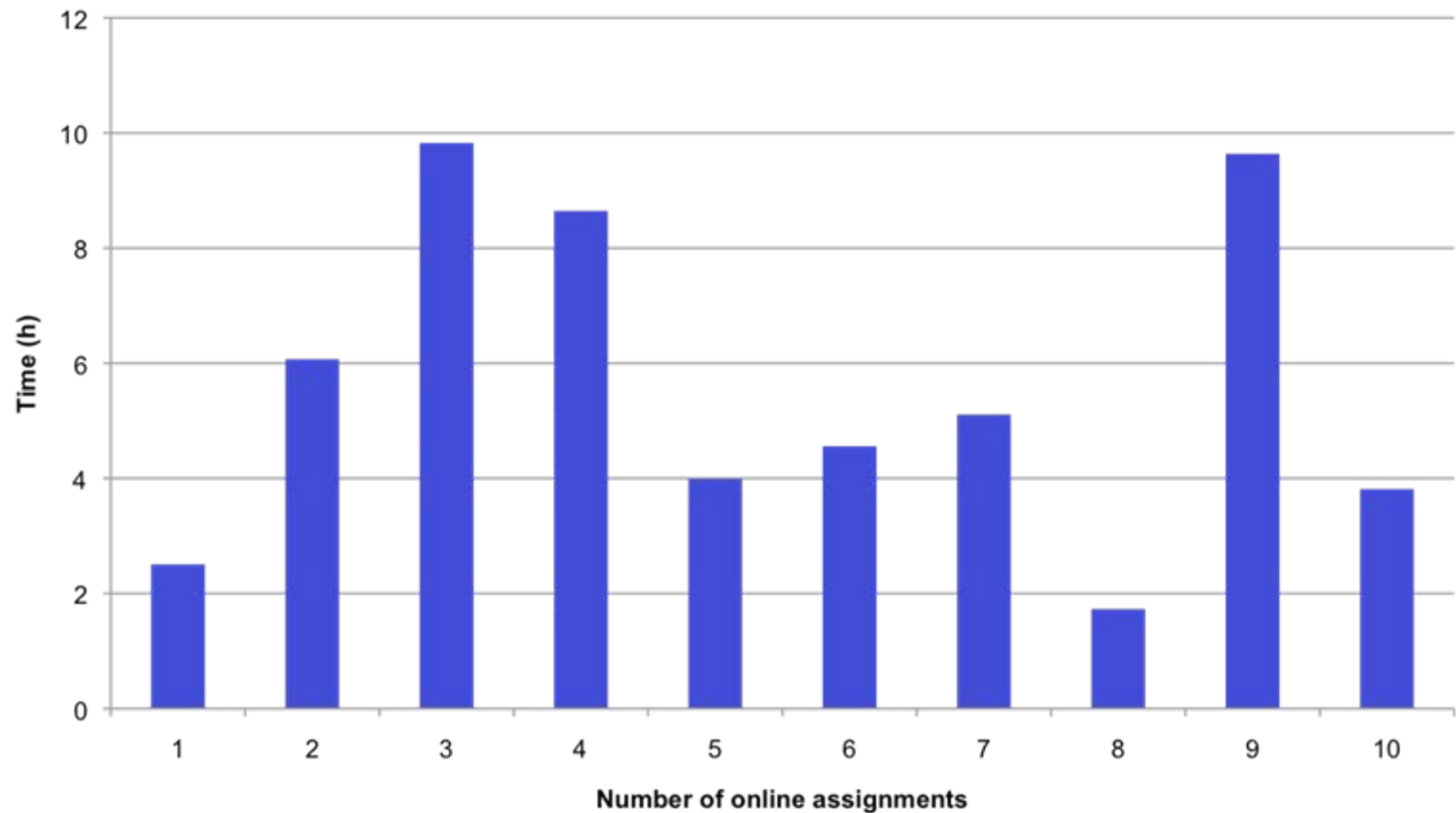
Computer math lab was used for:

- Practice for weekly quizzes
81%
- Practice for written home assignments
26%
- Review for final exam
21%
- Review for mid-terms written in class
16%



Time management

Average hours spend each week for online assignments

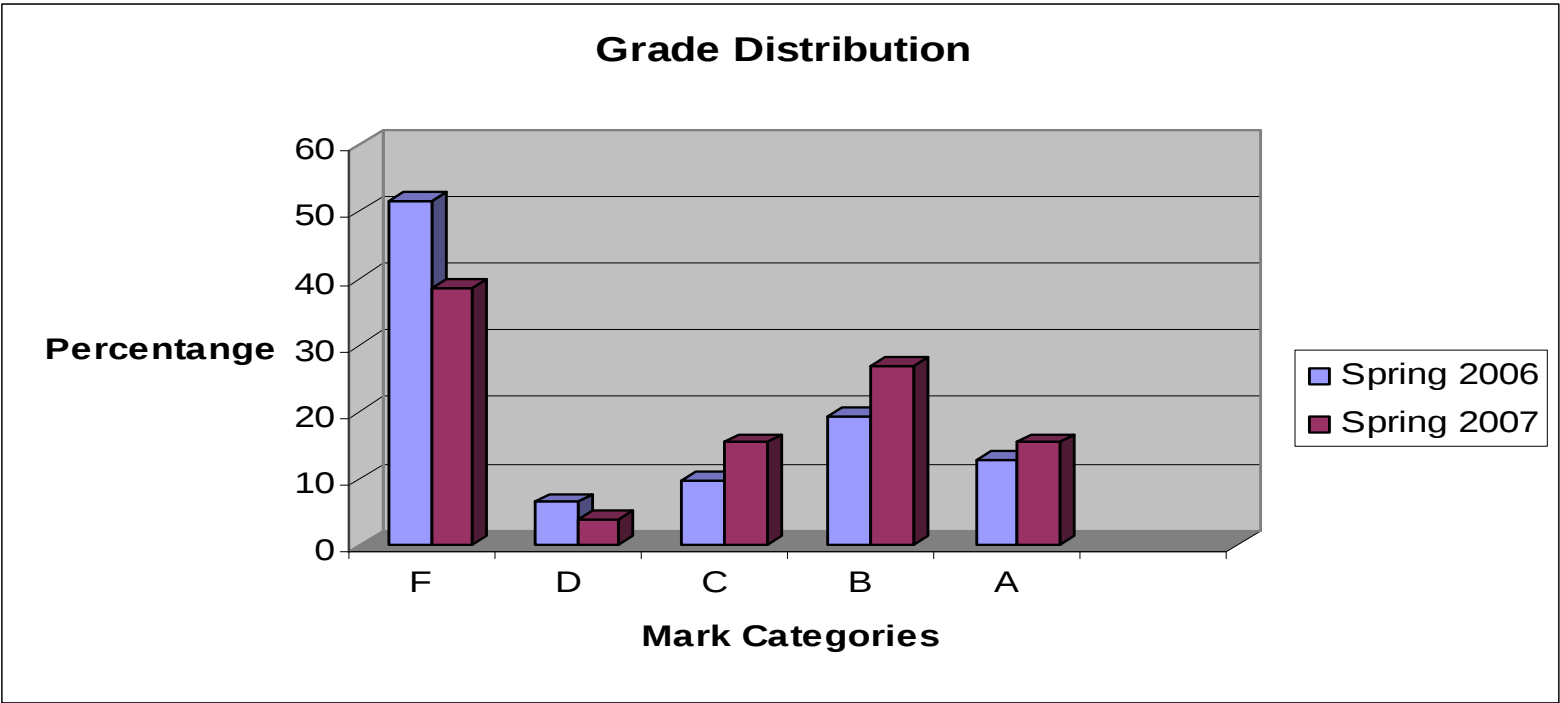




Grade distribution – Spring 2006 vs. Spring 2007

A	MPT Average	Pre- calculus Average	% Students
Spring 2006 (- L)	76	89	12.9
Spring 2007 (+L)	70.5	88	15.38

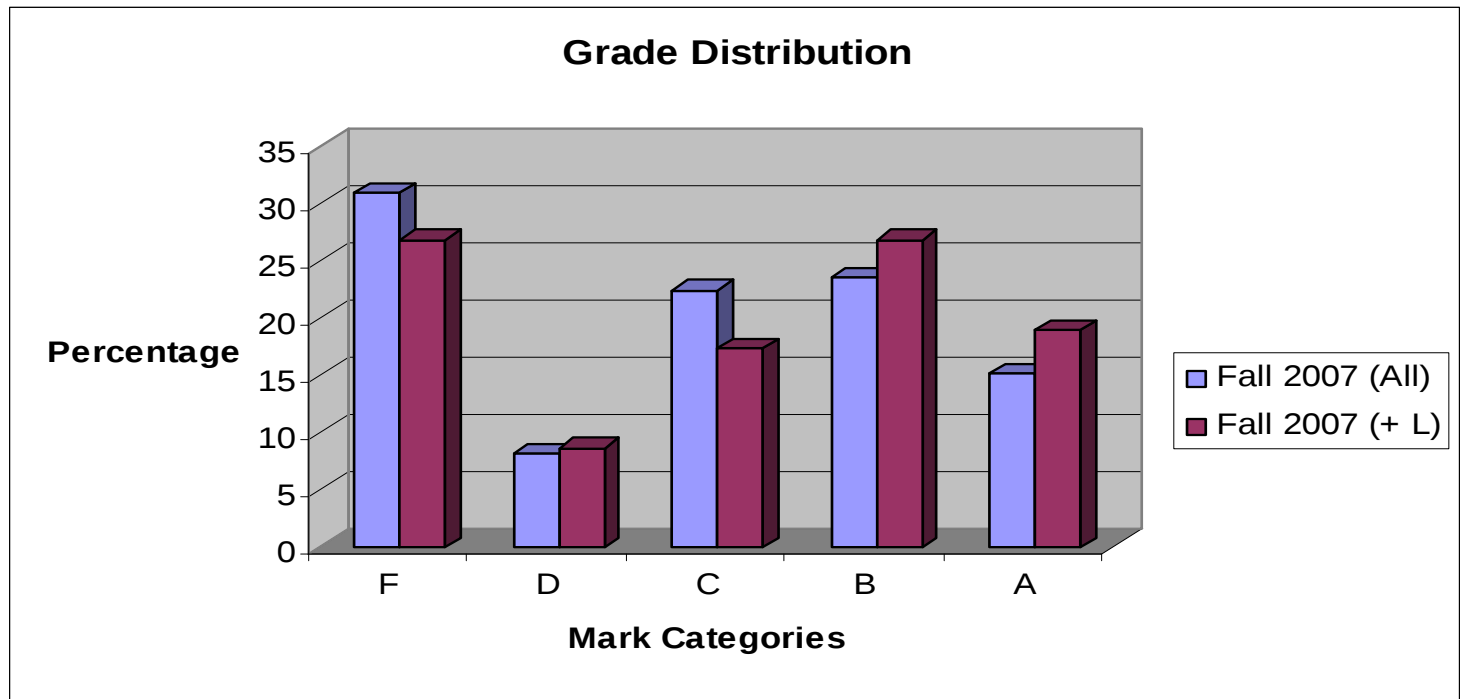
B	MPT Average	Pre- calculus Average	% Students
Spring 2006 (- L)	68.7	68.7	19.35
Spring 2007 (+L)	57.3	71.4	26.92





Grade comparison with/without math lab

A	MPT Average	Pre-calculus Average	% Students in category
Fall 2006 (-L)	72	85	12.6
Fall 2007 (+L)	72	88	18.8
? Lab effect		+3	+6.2





Examples of students' positive comments about the math lab

- I feel more confident
- I like math more because I understand it better
- I became more interested in math
- I see what the answers are more quickly than before
- I was able to see my mistakes
- I learned that there are more types of solutions for one problem
- I realized that practice makes perfect
- I realized my mistakes
- I realized that math is exciting
- I realized that math is not as hard as I thought
- I improved my math skills



Conclusion

Who may and who does benefit from the use of technology?

- Potentially everybody (students and instructors) can benefit from the use of technology
- But,

“I do not think that there is anything that can be done for the weak students. For most of them it is a maturity issue.”



Conclusion 1

- Students who were determined to learn took full advantage from the online tutorial and improved significantly
- A group of students tend to attribute their dissatisfaction to the novelty of the online software
 - Typical complains:
 - About time set aside for learning software
 - Not being able to show the entire solution



Conclusion 2

- It is essential for success to have a **core** group of instructors dedicated to work with technology
 - Their beliefs in the usefulness of technology
 - Their ability to handle software
 - Their beliefs about students' learning needs



Questions, discussion

“Mathematics is not only an impenetrable mystery to many, but has also, more than any other subject, been cast in the role as an ‘objective’ judge, in order to decide who in the society ‘can’ and who ‘cannot’. It therefore serves as the gate keeper to participation in the decision making processes of society. To deny some access to participation in mathematics is then also to determine, a priori, who will move ahead and who will stay behind.”

(Volmink, 1994, p. 51-52)

